

LG CAST RESIN TRANSFORMER



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- LG Industrial System Co., Ltd.

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LG Industrial Systems



ISO 9001 CERTIFICATE



LG CAST RESIN TRANSFORMER

Technical Performance (Copper Design)

Rated Voltage : up to 36 kV
Capacity : 50 ~ 10,000 kVA



LG CAST RESIN TRANSFORMER

INTRODUCTION

Great progress has been made in the development and improvement of transformers over the last decades. The application of high quality insulation and the suitable selection of the coil structure for high stress have contributed to the development of cast resin transformers.

The GOLDCAST transformers has succeeded in combining the advantage of oil-filled and dry-type transformers, which are fabricated with an epoxy resin with a low viscosity formulation.

The copper windings are completely embedded between layers of glass fiber and impregnated in a special process with pure resin mixed under vacuum conditions. This unique casting method makes it possible to assure void-free epoxy penetration of both the inner layer and turn-to-turn insulation. After casting, coils are cured in a temperature time sequence which is controlled by a microprocessor to guarantee full and stress-free adhesion of the resin to the conductors. It also provides a complete safeguard against cracks under all circumstances. This result of high technology application provides many unsurpassed characteristics.

FEATURES

- Moisture proof
- No partial discharge
- High overload capability
- Impulse voltage strength
- Short-circuit proof
- Thermal shock resistance
- Fire resistance
- Maintenance free
- Environmentally safe
- Low noise
- Expenditure saving

APPLICATIONS

GOLDCAST transformers can be used in various fields.

Here are just a few possible applications :

- Indoor or outdoor unit substations
- Industrial and petrochemical plants
- Off-shore platforms
- Commercial buildings
- Hospitals
- Shopping centers
- Water supplies
- Transit systems
- SCR power supplies
- Grid, ring or radial networks
- Station auxiliaries
- Pad mount applications


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GOLDCAST TRANSFORMER VIEW



- | | |
|----------------|--------------------------|
| 1 Lifting lugs | 6 Interphase lead |
| 2 LV terminal | 7 No-voltage tap changer |
| 3 Name plate | 8 Lower frame |
| 4 Upper frame | 9 Anti-vibration rubber |
| 5 HV terminal | 10 Wheel |



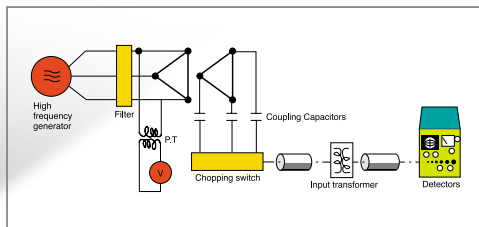
FEATURES

1Moisture proof

The complete casting of HV and LV coils under vacuum prevents the penetration of moisture into the winding and the break-down by ionization. Therefore it is suitable for both storage and operation in adverse environment including prolonged storage in 100% humidity and is capable of being switched on immediately after such storage without predrying.

2No partial discharge

There is no possibility of partial discharge in GOLDCAST transformers. Each high voltage coil is individually tested for partial discharge before assembly to ensure a partial discharge-free operation under all circumstances, and to guarantee the life expectancy of the insulation system. GOLDCAST transformers are free of partial discharge at least up to 1.2 times of the rated voltage and no visible corona at 2 times of the rated voltage.



(Corona test circuit)

3High overload capability

Based on the high thermal time constant factor of the windings, GOLDCAST transformers can be overloaded for a short duration considerably higher than oil immersed transformers. It has a greater capability to withstand sudden momentary high overloads such as might be encountered in heavy traction applications.

4Impulse voltage strength

GOLDCAST transformers have the same impulse levels compared to oil-immersed transformers. The coil are very resistant to impulse voltage. Impulse withstand levels to 200kV are available because of careful design and special structure. The impulse voltage stress of the HV coil is evenly distributed throughout the winding due to a suitable winding arrangement.

5Short circuit proof

The coil construction provides the highest mechanical withstand capability. The dynamic short circuit strength of this transformer is greatly superior to that of oil immersed transformers. In the event of a maximum short circuit, GOLDCAST transformers are not endangered mechanically, due to the dense glass fiber filling and the adhesion of epoxy resin to the conductors. In case of a short circuit, the conductors heat up much faster than the surrounding insulation. Therefore only a strong glass fiber reinforcement can prevent cracking of the coils.

6Thermal shock resistance

Tensile and bending strength of glass fiber reinforced epoxy resin is appreciably higher than that of quartz powder filled resin which has the disadvantage of becoming brittle and tending to crack when exposed to low temperature. Due to the complete combination of epoxy resin and glass fiber, even the worst temperature fluctuation will not induce the cracking of the coil.



FEATURES

7 Fire resistance

GOLDCAST transformers have a very excellent characteristic of self fire-extinguishing and fire resistance. So there would be no fear of spread of fire even if a fire took place around the electricity room. The transformers can be used indoors without anxiety, and it is not necessary to provide additional measures for safety.



- (a) Ignited for 2 minutes to the surface of cast coil with oxygen welding torch
 (b) As soon as the torch was removed from the surface of burning resin
 (c) The flame extinguished by itself after 15 seconds

8 Maintenance free

Maintenance is almost completely eliminated. No checking of liquid level and no dielectric test for moisture absorption is required. Due to the smooth coil surfaces, heavy dirt and dust build up is eliminated even under the worst circumstances. The recommended routine maintenance is an occasional visual inspection.

9 Environmentally safe

GOLDCAST transformers will not emit oil or toxic gases into the atmosphere. Therefore they do not pollute the environment and are recommended strongly as a replacement for askarelfilled(PCB) transformer. PCB is poisonous, chemically aggressive and can discharge dangerous gases at elevated temperature.

10 Low noise

The encapsulation of the core in a special resin and the design of the pressing mechanism have led to on an appreciable noise reduction. Noise is also reduced due to the sound suppressing effect of the elaborate core cutting and the coil support of elastic structure.

11 Expenditure saving

If the advantage of GOLDCAST transformers are taken into consideration already at planning stage, the overall costs of power supply system can often be considerably reduced. They are sufficiently compact for convenient installation in a building where space is generally limited and have much smaller power loss than oil-immersed and dry-type transformers. Total costs are lower even though cast resin transformers may be more expensive than other transformers.





SECTION VIEW



HV Coil



LV Coil

- | | | | |
|-----------------------|-------------------------|--------------------------|--------------------------|
| 1 Lifting lugs | 8 Lower frame | 15 Resin support block | 21 Trolley frame |
| 2 LV terminals | 9 Core yoke | 16 Resilient pad | 22 Bi-directional wheel |
| 3 HV coil | 10 Core bolt insulation | 17 Core leg | 23 HV conductors |
| 4 LV coil termination | 11 Core pressing bolts | 18 Tie bars | 24 Air ducts for cooling |
| 5 Core bandage | 12 Upper frame | 19 HV terminal | 25 LV conductors |
| 6 LV coil | 13 Coil clamp adjuster | 20 HV tapplings | |
| 7 Pulling holes | 14 Tapping link | 21 Anti-vibration rubber | |

CONSTRUCTION

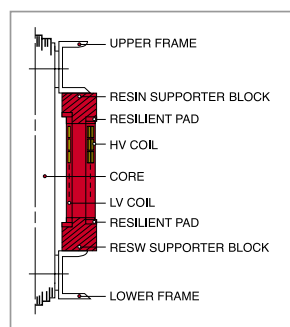
GOLDCAST transformers take pride in the ability to offer a wide variety of designs and configurations necessary to satisfy customer needs. Computers and CAD/CAM systems are used to quickly and accurately design and manufacture to meet specific customer requirements.

1 Core and frame

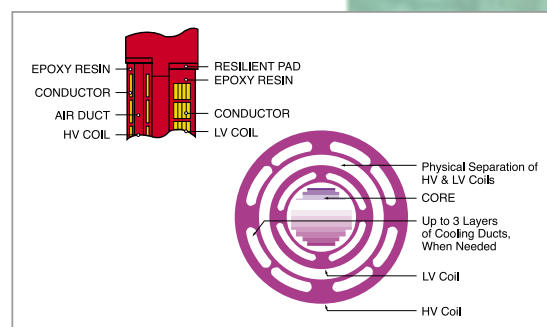
The core is made of highest quality, cold-rolled, grain-oriented, silicon steel and cut on the latest CNC machine. Three legs of the core are arranged in a single plane and interconnected with a yoke. The legs are of circular structure multi-ply arranged step-wise and are carefully interlaced with stepwise arranged yokes. The core is mitred at 45° angle and carefully stacked and pressed to obtain low loss, exciting current and noise. The core is insulated on both sides of each lamination and protected against corrosion by a resin coating and grounded in accordance with required standards. The frame consists of upper and lower steel channels. It hold the core and coil together. The under carriage is bolted to the bottom of the lower frame. The wheels enable the transformer to be moved either length-wise or side-wise. Lifting lugs and earthing terminals are fitted to the upper and lower frame respectively. To protect against corrosion, all steel parts are coated with epoxy paint.

2 Low voltage and high voltage winding

Copper wire insulated with a high grade is used in the winding construction. Turns are arranged in mutple sections and layers as dictated by design requirements. Cooling ducts are strategically placed within the windings to provide low thermal drop through thin sections of insulation and expose smooth and even surfaces for effective convection cooling. Completed windings are placed in close tolerance with molds and cast under high vacuum conditions using a very low viscosity epoxy resin. The resin penetrates and saturates all portions of the winding. After the molds are filled with epoxy resin, they are moved into carefully programmed ovens and the epoxy resin is fully cured. Finished coils contain smooth surfaces to enhance heat transfer to cooling air, and to prevent dirt or dust build-up. The complete saturation and penetration of the resin result in a winding free of partial discharge, well above operating voltage conditions. Glass cloth and fiberglass mat render outstanding mechanical properties to the winding.



Core and frame



Low voltage and high voltage winding

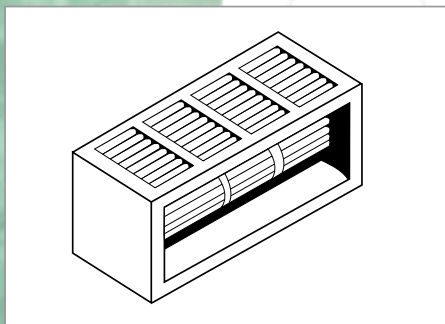


3 No-voltage tap changer

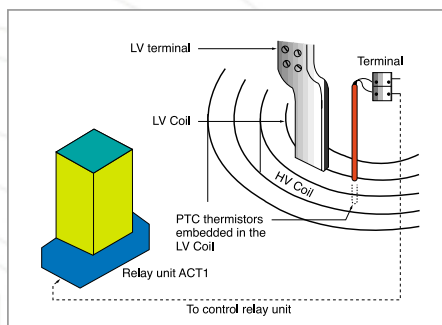
GOLDCAST transformers are provided with a reconnectable link tap changing device on the high voltage side of the transformer which will, when operated with the transformer de-energized, change the ratio of the transformation. The device is sturdy in construction and links are clearly indentifiable as to the tap selected.

4 Cooling fans

Forced cooling is a relatively simple method of increasing the capacity of cast resin transformers. This is especially advantageous for transformers which are highly loaded only for a few hours in a day and then operated at normal load for the rest of the time. These are mounted on both sides of the transformer bases. Through the use of cooling fans, a capacity increase of 30~50% can be achieved with minimal efforts. It is also very effective at sites of installation where the available space is limited. It is, however, necessary to provide an outlet large enough for the increased airflow. To avoid unnecessary fan operation, the control is automatic through thermal sensors.



Cooling fans



Temperature monitoring unit

5 Temperature monitoring unit

A temperature monitoring system protects the coils against overheating due to increased ambient temperature or overload and permits utilization of full transformer power at any required load cycle without hazard to the transformer. This system consists of a tripping unit and three temperature sensors buried in the upper portion of the low voltage coils so that the direct temperature measurement of the coils can be made. When the temperature of the coils exceeds its set value, a tripping unit operates and closes the contacts. The installation of second and third system is also possible at all times. With two system, one is connected to give an alarm and the other for tripping. The response temperature difference between the two systems is 20K.



CONSTRUCTION

6 Enclosure

GOLDCAST transformers are normally supplied without an enclosure (IP 00). Additional protection is offered by an enclosure to protect against solid bodies and liquids.

*Enclosure IP20

This has the protection against solid bodies greater than 12mm diameter and has sheet steel walls. The top and floor panels are perforated sheet steel. The connection cables are inserted through a cut out in the floor.

*Enclosure IP23

This is similar to enclosure IP20 but also has the protection against rain water up to 60° from the vertical. Because this enclosure acts as a trap, an adequate supply of air is necessary for ventilation.

7 Assembly

HV and LV coils are arranged coaxially and clamped rigidly. The support structure between the core and coils is resilient. Preventing the major part of vibrations and noise caused by magnetostriction from being transferred to the coils. The noise level can be dampened to a level equivalent to that of oil-immersed transformers.



QUALITY ASSURANCE

Quality assurance begins with a control of incoming materials and continuous throughout the various steps of the manufacturing process. Quality control is carried through the testing procedure of each transformer and ends only when the transformer is installed and operating. GOLDCAST transformers are tested in accordance with applicable standards prior to shipment as noted below. Additionally each high voltage coil is tested for partial discharge before assembly as a means to verify the integrity of the epoxy impregnation.

Note :

GOLDCAST transformers have fully equipped with facilities for testing cast epoxy resin transformers. Tests are performed as noted in the following table.

No.	Item	Routine Test	Type Test	Special Test
1	Measurement of winding insulation resistance	○		
2	Measurement of turns ratio	○		
3	Phase-relation test : Polarity, angular displacement and phase sequence	○		
4	No-load loss and exciting current	○		
5	Load loss and impedance voltage	○		
6	Applied potential dielectric test	○		
7	Induced voltage dielectric test	○		
8	Temperature rise test		○	
9	Impulse voltage test		○	
10	Measurement of sound level			○
11	Measurement of partial discharge			○
12	Short-circuit test			○
13	Heat cycle test		○	

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SPECIFICATION

1 Specification Data

GOLDCAST transformers are normally available with specification as follows :

Rated voltage

- HV coil : Up to 36KV
- LV coil : 0.4KV
- * GOLDCAST transformers with dual high voltage coils can also be supplied.

Tapping range

- Standard $\pm 2.5\%$, $\pm 5\%$
- * Other ratings are available by arrangement.

Power capacity

- Single phase : 20~2,000KVA
- Three phase : 50~10,000KVA
- Frequency : 50 Hz, 60 Hz
- Typical % impedance voltage : 4~8%
- * Other capacities and %impedance voltages are also available.

Connections

- HV coil : Delta
- LV coil : Star with neutral point
- * Other connection are available to meet requirements.

Temperature ratings (according to IEC 726)

- HV coil : Class F
- LV coil : Class F
- Max. ambient temperature : 40 °C
- Temperature rise limitation : 100K

Tolerance (according to IEC 726)

- Total losses : +10%
- Component losses : +15%(No-load and load losses)
- No-load current : +30%
- Impedance voltage : $\pm 10\%$ (at rated current)
- Voltage ratio : $\pm 0.5\%$ or 1/10 of measured impedance voltage at rated current in %, which is smaller.

2 Standards

GOLDCAST transformers conform to the requirements of IEC726(1982) standards. However they can also meet the requirements of the following standards upon request :

- ANSI / IEEE C57.12.01(1979)
: General requirements for dry-type distribution and power transformers.
- BS-171(1978)
: Power transformer.
- CSA standard C9-M(1981)
: Dry-type transformer.
- AS2374(1982)
: Power transformer.
- VDE 0532(1982)
: Transformatoren und Drosselspulen.
- * Transformers for rectifier application and other special purposes can be supplied according to the client's specification (Rapid transit system, Air and iron core reactors, Transmitter transformers, Precipitator transformers etc.)

3 Accessories

Normally provided accessories

- Terminal screws and links for HV tappings
- Name plate
- Ground wire clamping screw
- Protective cap for HV tappings
- Lifting lugs
- Danger labels

Optional accessories

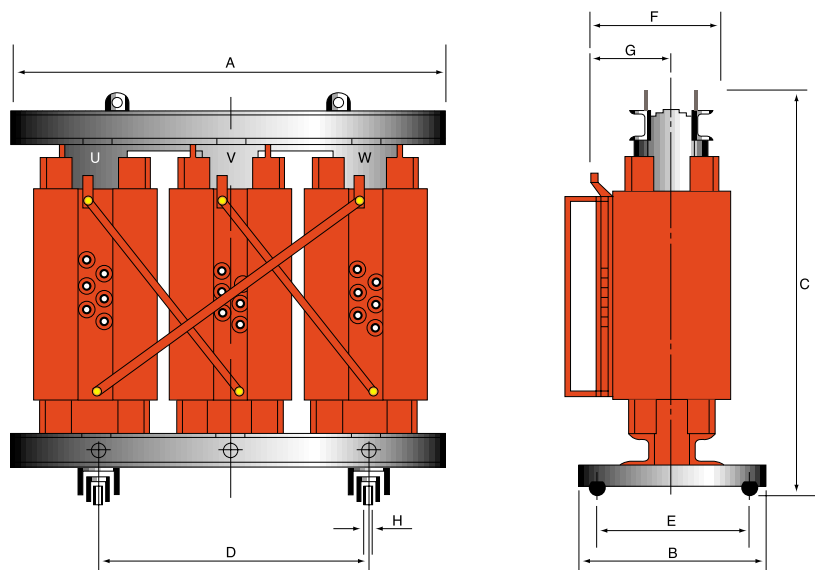
- PTC thermistor & relay unit
- Wheels
- Dial-type thermometer
- Anti-vibration pads
- Enclosure
- Anchor bolts

Special accessories

- Cooling fans and control box.

Technical Data

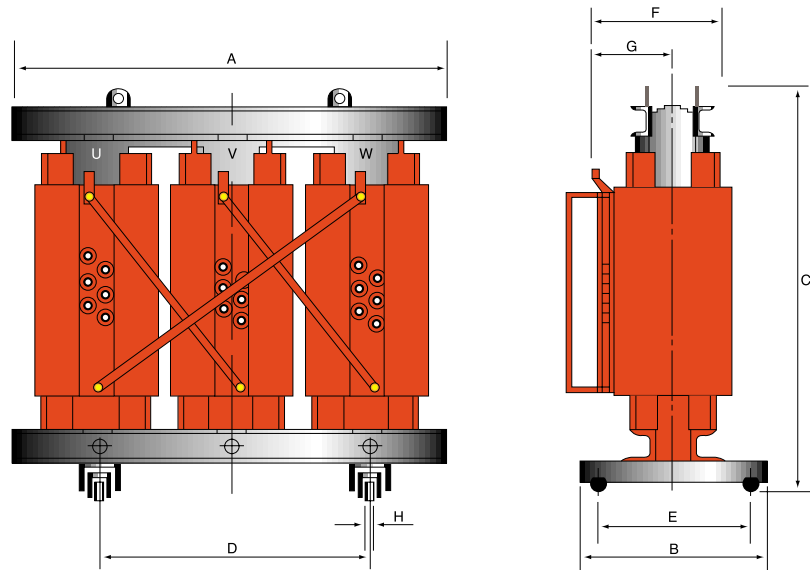
Temp. Rise 80K,60 Hz
Class 5kV, BIL HV : 75kV/LV : 30kV
ANSI/IEEE C 57. 12. 01



Capacity (kVA)	Type	Impedance Voltage (%)	No-Load Loss (W)	Load Loss (W) at 100 °C	Dimension(inches)								Weight (lbs)
					A	B	C	D	E	F	G	H	
112.5	GC-112/5	5.75	450	2350	41.3	19.7	40.9	27.6	16.9	18.5	10.2	1.2	1210
150	GC-150/5	5.75	550	2900	41.3	19.7	47.2	27.6	16.9	18.5	10.2	1.2	1430
225	GC-225/5	5.75	700	3500	45.3	25.6	48.8	29.9	22.8	19.9	10.6	1.2	2120
300	GC-300/5	5.75	850	3800	45.3	25.6	53.1	29.9	22.8	19.9	10.6	1.2	2510
500	GC-500/5	5.75	1200	6300	53.5	25.6	58.3	34.6	22.8	22.2	11.8	1.2	3640
750	GC-750/5	5.75	1800	7800	55.1	29.5	67.7	36.6	24.1	23.8	12.4	1.9	4890
1000	GC-1000/5	5.75	2300	9000	59.1	29.5	72.8	38.6	24.1	24.4	13.0	1.9	6060
1500	GC-1500/5	5.75	3100	13500	66.9	37.4	82.7	44.5	29.9	27.2	14.4	1.9	8700
2000	GC-2000/5	5.75	3600	16600	70.9	37.4	88.6	46.9	29.9	27.8	14.6	1.9	10700
2500	GC-2500/5	5.75	4600	19000	78.7	40.2	95.3	46.9	29.9	27.8	14.6	1.9	13000



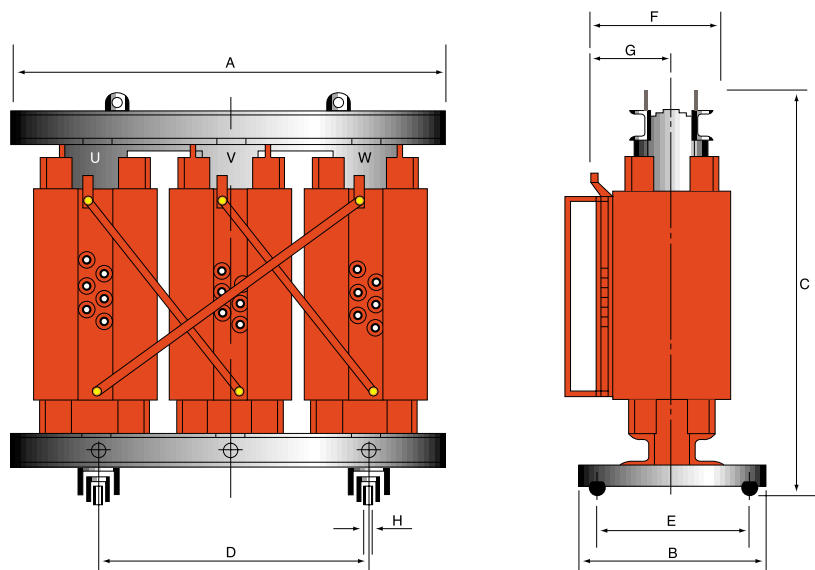
Temp. Rise 80K,60Hz
Class 15kV, BIL HV : 110kV/LV : 30kV
ANSI/IEEE C 57. 12. 01



Capacity (kVA)	Type	Impedance Voltage (%)	No-Load Loss (W)	Load Loss (W) at 100 °C	Dimension(inches)								Weight (lbs)
					A	B	C	D	E	F	G	H	
112.5	GC-112/15	5.75	520	2700	44.1	25.6	45.3	30.0	22.8	20.0	10.4	1.2	1370
150	GC-150/15	5.75	650	3200	44.1	25.6	51.6	30.0	22.8	20.0	10.4	1.2	1590
225	GC-225/15	5.75	850	3700	51.2	29.5	54.7	33.5	24.1	23.2	11.2	1.9	2360
300	GC-300/15	5.75	1000	4300	51.2	29.5	61.4	33.5	24.1	23.2	11.2	1.9	2820
500	GC-500/15	5.75	1550	7100	59.1	29.5	68.9	39.4	24.1	27.6	12.8	1.9	4270
750	GC-750/15	5.75	2100	8600	63.0	37.4	74.4	41.7	30.0	27.8	13.2	1.9	5580
1000	GC-1000/15	5.75	2750	9000	68.9	37.4	76.8	45.7	30.0	28.1	14.4	1.9	7120
1500	GC-1500/15	5.75	3500	12000	70.9	40.2	82.7	46.9	34.3	29.9	14.8	1.9	9390
2000	GC-2000/15	5.75	4600	16600	78.7	40.2	91.7	51.6	34.3	31.7	15.9	1.9	11660
2500	GC-2500/15	5.75	5200	19000	83.5	40.2	98.4	51.6	34.3	31.7	15.9	1.9	13400

Technical Data

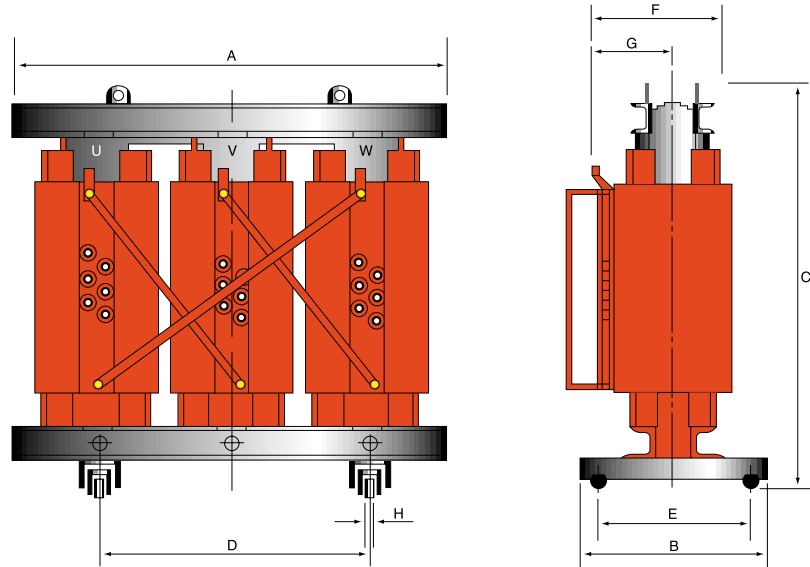
Temp. Rise 100K, 50 Hz
Class 12kV, BIL 75kV, P.F. 28kV
IEC 726



Capacity (kVA)	Type	Impedance Voltage (%)	No-Load Loss (W)	Load Loss (W) at 75 °C	Dimension(mm)								Weight (kg)
					A	B	C	D	E	F	G	H	
150	GC-150/10	5	520	3200	400	500	1200	700	430	470	260	30	800
250	GC-250/10	5	800	3700	1150	650	1250	760	588	500	270	30	1140
400	GC-400/10	6	1100	5600	1400	650	1350	900	580	540	300	30	1470
500	GC-500/10	6	1300	6700	1400	650	1450	900	580	540	300	30	1890
630	GC-630/10	6	1500	7500	1450	750	1610	930	612	560	310	48	2170
800	GC-800/10	6	1700	9000	1450	750	1750	930	612	560	310	48	2650
1000	GC-1000/10	6	2300	9000	1600	750	1780	1050	612	610	340	48	3350
1250	GC-1250/10	6	2600	12400	1700	950	1970	1050	760	610	340	48	3940
1600	GC-1600/10	6	3000	16000	1700	950	2200	1130	760	660	360	48	4630
2000	GC-2000/10	6	3500	16900	1850	950	2300	1190	760	720	390	48	5970
2500	GC-2500/10	6	4600	18900	2000	1020	2400	1380	870	730	400	48	6400



Temp. Rise 100K,50 Hz
Class 24kV, BIL 125kV, P.F. 50kV
IEC 726



Capacity (kVA)	Type	Impedance Voltage (%)	No-Load Loss (W)	Load Loss (W) at 75°C	Dimension(mm)								Weight (kg)
					A	B	C	D	E	F	G	H	
150	GC-150/20	6	700	3000	1200	650	1250	760	580	450	265	30	870
250	GC-250/20	6	1100	4500	1300	650	1300	860	580	490	280	30	1370
400	GC-400/20	6	1300	5100	1450	750	1500	970	612	550	310	48	1750
500	GC-500/20	6	1500	6000	1450	750	1600	970	612	550	310	48	1960
630	GC-630/20	6	1800	7600	1600	750	1800	1060	612	590	330	48	2230
800	GC-800/20	6	2200	8500	1600	750	1900	1060	612	590	330	48	2750
1000	GC-1000/20	6	2700	10000	1750	950	1950	1150	800	640	350	48	3360
1250	GC-1250/20	6	3100	13200	1800	1020	2100	1150	800	640	350	48	3980
1600	GC-1600/20	6	3500	15300	1800	1020	2240	1230	870	670	380	48	4850
2000	GC-2000/20	6	4300	17500	2000	1020	2350	1320	870	730	400	48	5910
2500	GC-2500/20	6	5000	19000	2200	1020	2400	1380	870	800	410	48	6730



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without notice.



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